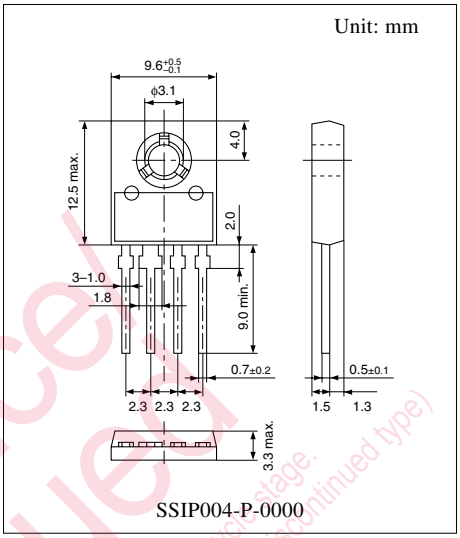
AN78xxR/AN78MxxR Series

4-pin positive output voltage regulator with reset pin (1 A/500 mA type)

■ Overview

The AN78xxR series and the AN78MxxR series are the fixed positive output type monolithic voltage regulators with reset pin. Stabilized fixed output voltage is obtained from unstable DC input voltage without using any external components. Three types of output voltage, 5V, 9V and 12V, are available for the AN78xxR series, and four types, 5V, 8V, 9V and 12V, are available for the AN78MxxR series. They can be used in power circuits with current capacity of 1A/500mA. On/off of output voltage can be controlled by the reset pin.

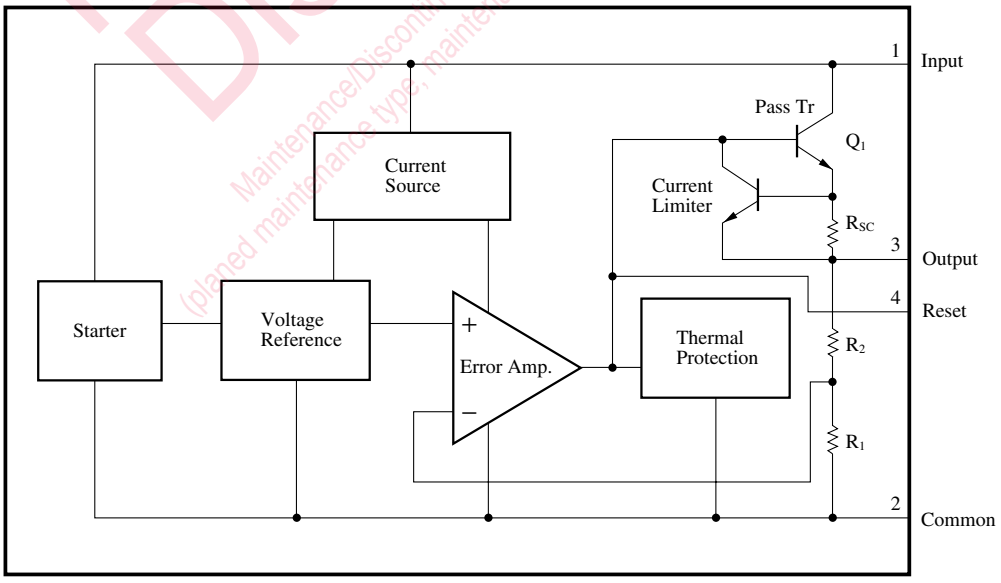


SSIP004-P-0000

■ Features

- No external components
- Maximum output current: 1A (AN78xxR)
  500mA (AN78MxxR)
- Output voltage: 5V, 9V, 12V (AN78xxR)
  5V, 8V, 9V, 12V (AN78MxxR)
- Built-in overcurrent limit circuit
- Built-in thermal overload protection circuit
- Built-in ASO (area of safe operation) protection circuit
- On/off of output voltage can be controlled by reset pin

■ Block Diagram



■ Absolute Maximum Ratings at $T_a = 25°C$

Parameter	Symbol	Rating	Unit
Input voltage	V_I	35	V
Power dissipation	P_D	10 *	W
Operating ambient temperature	T_{opr}	–20 to +80	°C
Storage temperature	T_{stg}	–55 to +150	°C

* Follow the derating curve. When T_j exceeds 150°C, the internal circuit cuts off the output.

■ Electrical Characteristics at $T_a = 25°C$

[1] AN78xxR series

• AN7805R (1A, 5V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25°C$	4.8	5	5.2	V
Output voltage tolerance	V_O	$V_I = 8$ to 20V, $I_O = 5$mA to 1A, $T_j = 0$ to 125°C, $P_D \leq 15$W	4.75	—	5.25	V
Line regulation	REG_{IN}	$V_I = 7.5$ to 25V, $T_j = 25°C$	—	3	100	mV
		$V_I = 8$ to 12V, $T_j = 25°C$	—	1	50	mV
Load regulation	REG_L	$I_O = 5$mA to 1.5A, $T_j = 25°C$	—	15	100	mV
		$I_O = 250$ to 750mA, $T_j = 25°C$	—	5	50	mV
Bias current	I_{Bias}	$T_j = 25°C$	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	$V_I = 7.5$ to 25V, $T_j = 25°C$	—	—	1.3	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	$I_O = 5$mA to 1A, $T_j = 25°C$	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	40	—	µV
Ripple rejection ratio	RR	$V_I = 8$ to 18V, $I_O = 100$mA, f = 120Hz	62	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	$I_O = 1$A, $T_j = 25°C$	—	2	—	V
Output impedance	Z_O	f = 1kHz	—	17	—	mΩ
Output short-circuit current	$I_{O(Short)}$	$V_I = 35$V, $T_j = 25°C$	—	700	—	mA
Peak output current	$I_{O(Peak)}$	$T_j = 25°C$	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5$mA, $T_j = 0$ to 125°C	—	– 0.3	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	$T_j = 25°C$, $I_{I(Reset)} = 1$mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	$T_j = 25°C$	—	—	1	mA

Note 1) The specified condition $T_j = 25°C$ means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, $V_I = 10$V, $I_O = 500$mA, $C_I = 0.33$µF, $C_O = 0.1$µF and $T_j = 0$ to 125°C

■ Electrical Characteristics at T_a = 25°C (continued)

• AN7809R (1A, 9V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	8.65	9	9.35	V
Output voltage tolerance	V_O	V_I = 12 to 24V, I_O = 5mA to 1A, T_j = 0 to 125°C, $P_D \leq$ 15W	8.55	—	9.45	V
Line regulation	REG_{IN}	V_I = 11.5 to 26V, T_j = 25°C	—	7	180	mV
		V_I = 12 to 18V, T_j = 25°C	—	2	90	mV
Load regulation	REG_L	I_O = 5mA to 1.5A, T_j = 25°C	—	12	180	mV
		I_O = 250 to 750mA, T_j = 25°C	—	4	90	mV
Bias current	I_{Bias}	T_j = 25°C	—	3.9	8	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 11.5 to 26V, T_j = 25°C	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5mA to 1A, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	57	—	µV
Ripple rejection ratio	RR	V_I = 12 to 22V, I_O = 100mA, f = 120Hz	56	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 1A, T_j = 25°C	—	2	—	V
Output impedance	Z_O	f = 1kHz	—	16	—	mΩ
Output short-circuit current	$I_{O(Short)}$	V_I = 26V, T_j = 25°C	—	700	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	− 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 15V, I_O = 500mA, C_I = 0.33µF, C_O = 0.1µF and T_j = 0 to 125°C

• AN7812R (1A, 12V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	11.5	12	12.5	V
Output voltage tolerance	V_O	V_I = 15 to 27V, I_O = 5mA to 1A, T_j = 0 to 125°C, $P_D \leq$ 15W	11.4	—	12.6	V
Line regulation	REG_{IN}	V_I = 14.5 to 30V, T_j = 25°C	—	10	240	mV
		V_I = 16 to 22V, T_j = 25°C	—	3	120	mV
Load regulation	REG_L	I_O = 5mA to 1.5A, T_j = 25°C	—	12	240	mV
		I_O = 250 to 750mA, T_j = 25°C	—	4	120	mV
Bias current	I_{Bias}	T_j = 25°C	—	4	8	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 14.5 to 30V, T_j = 25°C	—	—	1	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5mA to 1A, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	75	—	µV
Ripple rejection ratio	RR	V_I = 15 to 25V, I_O = 100mA, f = 120Hz	55	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 1A, T_j = 25°C	—	2	—	V
Output impedance	Z_O	f = 1kHz	—	18	—	mΩ
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	700	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	2	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	− 0.8	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, V_I = 19V, I_O = 500mA, C_I = 0.33µF, C_O = 0.1µF and T_j = 0 to 125°C

■ Electrical Characteristics at T_a = 25°C (continued)

[2] AN78MxxR series

• AN78M05R (500mA, 5V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	4.8	5	5.2	V
Output voltage tolerance	V_O	V_I = 7.5 to 20V, I_O = 5 to 350mA, T_j = 0 to 125°C, $P_D \leq$ 15W	4.75	—	5.25	V
Line regulation	REG_{IN}	V_I = 7.5 to 25V, T_j = 25°C	—	3	100	mV
		V_I = 8 to 25V, T_j = 25°C	—	1	50	mV
Load regulation	REG_L	I_O = 5 to 500mA, T_j = 25°C	—	20	100	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	50	mV
Bias current	I_{Bias}	T_j = 25°C	—	4.6	6	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 8 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5 to 350mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	40	—	μV
Ripple rejection ratio	RR	V_I = 8 to 18V, I_O = 100mA, f = 120Hz	62	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 500mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.

Note 2) Unless otherwise specified, V_I = 10V, I_O = 350mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

• AN78M08R (500mA, 8V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	T_j = 25°C	7.7	8	8.3	V
Output voltage tolerance	V_O	V_I = 10.5 to 23V, I_O = 5 to 350mA, T_j = 0 to 125°C, $P_D \leq$ 15W	7.6	—	8.4	V
Line regulation	REG_{IN}	V_I = 10.5 to 25V, T_j = 25°C	—	6	100	mV
		V_I = 11 to 25V, T_j = 25°C	—	2	50	mV
Load regulation	REG_L	I_O = 5 to 500mA, T_j = 25°C	—	25	160	mV
		I_O = 5 to 200mA, T_j = 25°C	—	10	80	mV
Bias current	I_{Bias}	T_j = 25°C	—	4.1	6	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	V_I = 10.5 to 25V, T_j = 25°C	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	I_O = 5 to 350mA, T_j = 25°C	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	52	—	μV
Ripple rejection ratio	RR	V_I = 11.5 to 21.5V, I_O = 100mA, f = 120Hz	56	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	I_O = 500mA, T_j = 25°C	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	V_I = 35V, T_j = 25°C	—	300	—	mA
Peak output current	$I_{O(Peak)}$	T_j = 25°C	—	0.7	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	I_O = 5mA, T_j = 0 to 125°C	—	– 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	T_j = 25°C, $I_{I(Reset)}$ = 1mA	—	—	1	V
Reset input current	$I_{I(Reset)}$	T_j = 25°C	—	—	1	mA

Note 1) The specified condition T_j = 25°C means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.

Note 2) Unless otherwise specified, V_I = 14V, I_O = 350mA, C_I = 0.33μF, C_O = 0.1μF and T_j = 0 to 125°C

■ Electrical Characteristics at $T_a = 25°C$ (continued)

• AN78M09R (500mA, 9V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25°C$	8.65	9	9.35	V
Output voltage tolerance	V_O	$V_I = 11.5$ to 24V, $I_O = 5$ to 350mA, $T_j = 0$ to 125°C, $P_D \leq 15W$	8.55	—	9.45	V
Line regulation	REG_{IN}	$V_I = 11.5$ to 25V, $T_j = 25°C$	—	7	100	mV
		$V_I = 12$ to 25V, $T_j = 25°C$	—	2	50	mV
Load regulation	REG_L	$I_O = 5$ to 500mA, $T_j = 25°C$	—	25	180	mV
		$I_O = 5$ to 200mA, $T_j = 25°C$	—	10	90	mV
Bias current	I_{Bias}	$T_j = 25°C$	—	4.1	6.0	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	$V_I = 12$ to 25V, $T_j = 25°C$	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	$I_O = 5$ to 350mA, $T_j = 25°C$	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	60	—	µV
Ripple rejection ratio	RR	$V_I = 12$ to 22V, $I_O = 100mA$, f = 120Hz	56	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	$I_O = 500mA$, $T_j = 25°C$	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	$V_I = 35V$, $T_j = 25°C$	—	300	—	mA
Peak output current	$I_{O(Peak)}$	$T_j = 25°C$	—	0.7	—	A
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5mA$, $T_j = 0$ to 125°C	—	− 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	$T_j = 25°C$, $I_{I(Reset)} = 1mA$	—	—	1	V
Reset input current	$I_{I(Reset)}$	$T_j = 25°C$	—	—	1	mA

Note 1) The specified condition $T_j = 25°C$ means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, $V_I = 15V$, $I_O = 350mA$, $C_I = 0.33µF$, $C_O = 0.1µF$ and $T_j = 0$ to 125°C

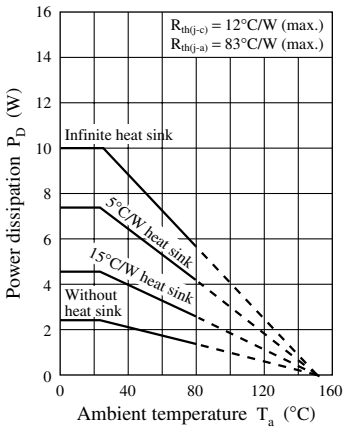
• AN78M12R (500mA, 12V type)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output voltage	V_O	$T_j = 25°C$	11.5	12	12.5	V
Output voltage tolerance	V_O	$V_I = 14.5$ to 27V, $I_O = 5$ to 350mA, $T_j = 0$ to 125°C, $P_D \leq 15W$	11.4	—	12.6	V
Line regulation	REG_{IN}	$V_I = 14.5$ to 30V, $T_j = 25°C$	—	8	100	mV
		$V_I = 16$ to 30V, $T_j = 25°C$	—	2	50	mV
Load regulation	REG_L	$I_O = 5$ to 500mA, $T_j = 25°C$	—	25	240	mV
		$I_O = 5$ to 200mA, $T_j = 25°C$	—	10	120	mV
Bias current	I_{Bias}	$T_j = 25°C$	—	4.3	6	mA
Bias current fluctuation to input	$\Delta I_{Bias(IN)}$	$V_I = 14.5$ to 30V, $T_j = 25°C$	—	—	0.8	mA
Bias current fluctuation to load	$\Delta I_{Bias(L)}$	$I_O = 5$ to 350mA, $T_j = 25°C$	—	—	0.5	mA
Output noise voltage	V_{no}	f = 10Hz to 100kHz	—	75	—	µV
Ripple rejection ratio	RR	$V_I = 15$ to 25V, $I_O = 100mA$, f = 120Hz	55	—	—	dB
Minimum input/output voltage difference	$V_{DIF(min)}$	$I_O = 500mA$, $T_j = 25°C$	—	2	—	V
Output short-circuit current	$I_{O(Short)}$	$V_I = 35V$, $T_j = 25°C$	—	300	—	mA
Peak output current	$I_{O(Peak)}$	$T_j = 25°C$, $V_I = 35V$	—	700	—	mA
Output voltage temperature coefficient	$\Delta V_O/T_a$	$I_O = 5mA$, $T_j = 0$ to 125°C	—	− 0.5	—	mV/°C
Output voltage at reset	$V_{O(Reset)}$	$T_j = 25°C$, $I_{I(Reset)} = 1mA$	—	—	1	V
Reset input current	$I_{I(Reset)}$	$T_j = 25°C$	—	—	1	mA

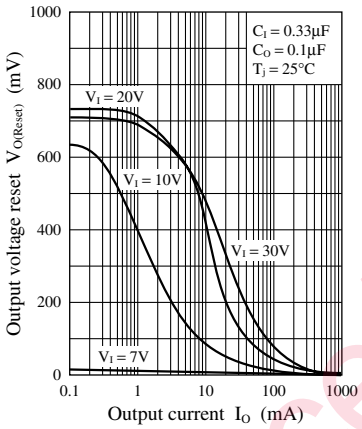
Note 1) The specified condition $T_j = 25°C$ means that the test should be carried out within so short a test time (within 10ms) that the characteristic value drift due to the chip junction temperature rise can be ignored.
Note 2) Unless otherwise specified, $V_I = 19V$, $I_O = 350mA$, $C_I = 0.33µF$, $C_O = 0.1µF$ and $T_j = 0$ to 125°C

■ Main Characteristics

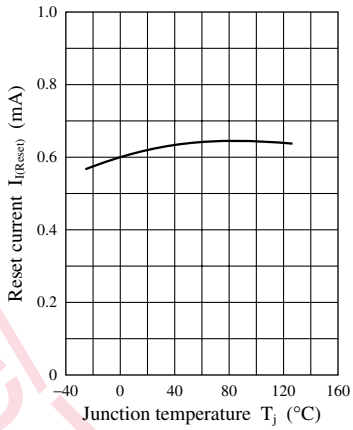
P_D — T_a



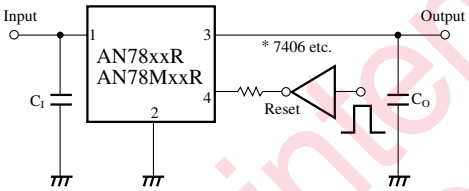
$V_{O(Reset)}$ — I_O



$I_{I(Reset)}$ — T_j



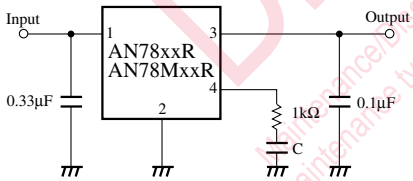
■ Basic Regulator Circuit



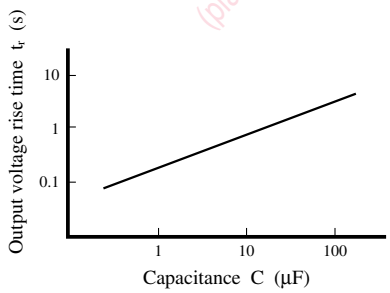
* For TTL, an open collector type inverter, buffer, gate etc. can be used.
Beware of the breakdown of TTL, as the reset pin bears voltage higher than the output voltage V_O by 1 to 2V.
C_I is necessary when the input line is long.
C_O improves the transient response.

■ Application Circuit Example

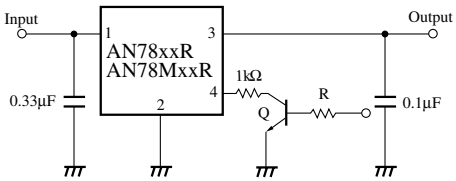
1. Soft start circuit

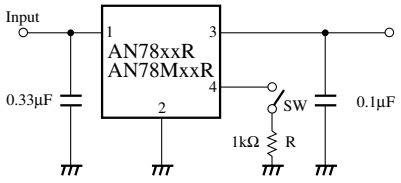


* Control of output voltage rise time



2. Several output reset circuits





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(5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
 Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

(6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.